

Claims

1. A speaker array apparatus, comprising:
 - a speaker array that has a plurality of speakers for outputting audio beams based on a test audio signal;
 - 5 a test sound sweep portion that sweeps with the audio beams;
 - a microphone that is placed in a listening position and collects a test sound including direct sounds and reflected sounds of the audio beams output from the speaker array;
 - a storage portion that stores a signal level of the test sound collected
 - 10 by the microphone, and sweep angles with which audio beams corresponding to the test sound are output;
 - a selection portion that selects a plurality of peaks of the signal level based on the signal level of the test sound stored in the storage portion; and
 - a beam setting portion that sets the sweep angles of the selected
 - 15 plurality of peaks as beam output angles which are angles to output audio beams of channels of a multi-channel surround-sound respectively.
2. The speaker array apparatus according to claim 1, wherein the beam setting portion sets a sweep angle of a peak where the signal level of the test
- 20 sound is the highest, as a beam output angle of a center channel of the multi-channel surround-sound.
3. The speaker array apparatus according to claim 1, wherein when the number of peaks selected from the signal level of the test sound stored in the
- 25 storage portion is smaller than the number of channels of the multi-channel

surround-sound, the beam setting portion sets the sweep angles of the selected peaks as beam output angles of one or more channels of the multi-channel surround-sound, and sets sounds of channels other than the channels for which the beam output angles are set, as direct sounds to be output to be propagated
5 directly to the listening position.

4. The speaker array apparatus according to claim 2, further comprising an informing portion that provides at least information to prompt the user to change the listening position or to prompt the user to change a sound
10 reproduction method when the beam output angle of the center channel of the multi-channel surround-sound set by the beam setting portion is shifted from a direction perpendicular to a front surface of the speaker array by an angle greater or equal to a predetermined angle.

15 5. The speaker array apparatus according to claim 2, wherein when the output angles set for the channels respectively are asymmetric with respect to the beam output angle of the center channel, the beam setting portion forms a signal localization of one of the channels as a phantom using audio beams directed in a plurality of directions so as to form a symmetric sound field.

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6. The speaker array apparatus according to claim 1, further comprising an input portion that accepts an input of installation position information of a body of the speaker array apparatus,

wherein the beam setting portion selects a plurality of peaks from the
25 signal level of the test sound stored in the storage portion based on the

installation position information of the body.

7. The speaker array apparatus according to claim 1, wherein the test
sound sweep portion modulates the signal level of the test sound with an
5 envelope having a maximum at the center of a sweep range of the audio
beams.

8. The speaker array apparatus according to claim 1, wherein the
speaker array outputs audio beams based on a test audio signal having no
10 correlation and limited to a band where beams can be formed.

9. A method for setting audio beams in a speaker array apparatus,
comprising:

outputting audio beams based on a test audio signal from a speaker
15 array having a plurality of speakers;
sweeping with the audio beams;
collecting, in a listening position, a test sound including direct sounds
and reflected sounds of the audio beams output from the speaker array;
storing a signal level of the test sound collected in the sound collecting
20 step, and sweep angles with which audio beams corresponding to the test
sound are output, so as to associate the signal level with the sweep angles;
selecting a plurality of peaks of the signal level based on the stored
signal level of the test sound; and
setting sweep angles of the plurality of peaks selected in the selecting
25 step, as beam output angles which are angles to output audio beams of

channels of a multi-channel surround-sound.

10. The method for setting audio beams according to claim 9, wherein in the beam setting step, a sweep angle of a peak where the signal level of the test sound is the highest is set as a beam output angle of a center channel of the multi-channel surround-sound.

11. The method for setting audio beams according to claim 9, wherein in the beam setting step, when the number of peaks selected from the stored signal level of the test sound is smaller than the number of channels of the multi-channel surround-sound, the sweep angles of the selected peaks are set as beam output angles of one or more channels of the multi-channel surround-sound, while sounds of channels other than the channels for which the beam output angles are set are set as direct sounds to be output to be propagated directly to the listening position.

12. The method for setting audio beams according to claim 10, further comprising the process of providing at least information to prompt the user to change the listening position or to prompt the user to change a sound reproduction method when the beam output angle of the center channel of the multi-channel surround-sound set by the beam setting step is shifted from a direction perpendicular to a front surface of the speaker array by an angle greater than or equal to a predetermined angle.

13. The speaker array apparatus according to claim 10, wherein in the

beam setting step, when the output angles set for the channels respectively are asymmetric with respect to the beam output angle of the center channel, a signal localization of one of the channels is formed as a phantom using audio beams directed in a plurality of directions so as to form a symmetric sound field.

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14. The method for setting audio beams according to claim 9, further comprising the process of accepting an input of installation position information of a body of the speaker array apparatus,

wherein in the beam setting step, a plurality of peaks are selected from
10 the signal level of the test sound stored in the storage portion based on the installation position information of the body.

15. The method for setting audio beams according to claim 9, wherein in the test sound sweep step, the signal level of the test sound is modulated with
15 an envelope having a maximum at the center of a sweep range of the audio beams.

16. The method for setting audio beams according to claim 9, wherein audio beams based on a test audio signal having no correlation and limited to a
20 band where beams can be formed are output in the audio beam output step.